**Unit 3: Metabolism and Cell Energetics**

**Read:** Chapter 8 (review enzymes), Chapter 9, Chapter 10, Chapter 40 (sections 3 and 4)

**Videos**: Bozeman – #12, 13, 14, Gibbs Free Energy, Thermoregulation, Bioenergetics

Crash Course – ATP/Respiration #7, Photosynthesis #8

**Objectives:**

1. Describe what free energy is.
2. Explain how life is able to adhere to the laws of thermodynamics and accomplish the following life processes:
   1. Growth
   2. Increase in Order/Maintain organization
   3. Reproduction
3. Describe how metabolic pathways maximize efficiency and control release of free energy.
4. Describe methods of obtaining free energy by organisms.
5. Describe the relationship of metabolic rate and size.
6. Describe what happens if there is an *excess* of free energy or an *insufficient* amount of free energy for an organism.
7. How can changes in free energy affect individuals, populations or ecosystems?
8. Be able to solve a Gibbs free energy math problem.
9. Describe the role of ATP in the production of cellular work.
10. Compare exergonic and endergonic processes. Provide several examples of each.
11. Compare anabolic and catabolic processes. Provide several examples of each.
12. Compare/contrast the major features of chemoheterotrophic and photoautotrophic nutritional processes.
13. Explain the necessity of electron shuttles in metabolic pathways.
14. Explain the inputs, major processes, and outputs of glycolysis, fermentation, and aerobic cellular respiration.
15. Trace the movement of energy and matter through all cell respiration processes.
16. Explain the inputs, major processes, and outputs of the light reactions and the Calvin Cycle.
17. Trace the movement of energy and matter through all photosynthetic processes.
18. Describe the process of chemiosmosis and compare its function in photosynthetic and respiratory pathways.
19. Explain the relationship between photosynthesis and respiration at the subcellular, organismal, and ecosystem levels of organization.
20. Compare the relative efficiencies of photosynthesis, anaerobic cellular respiration and aerobic cellular respiration.
21. Explain how energetic/metabolic requirements contribute to the adaptations of organisms. (thermoregulation, respiration, circulation and digestion)
22. Propose experimental designs by which the rate of photosynthesis and cell respiration can be measured and studied.
23. Use the equation for Gibbs free energy to determine if a reaction is endo or exothermic.
24. Use the equation for Temperature Coefficient Q10 to determine if a temperature change will affect respiration.